

## CASE STUDY - Riveting/Bucking

### TASK TITLE: Riveting/Bucking

<b>Task Description:</b>	<p>Riveting and bucking involves placement and fastening of rivets to hold sheet metal to a metal frame or to other sheet metal. The task requires a hard, heavy surface to pound against (i.e., the buck, a fist-sized, or smaller, piece of metal and a tool to pound with, being either a hammer or powered riveter. The flat head of the rivet is held by the buck on one side while the rivet is flattened out on the other by the hammer or riveter. Other tools used may be a metal stick to position the holes of the two pieces being mated, cleats which also act as guides, grinders, drills, screwdrivers, and pliers.</p> <p>Typical work locations in which sheet metal riveting and bucking are performed might include:</p> <ul style="list-style-type: none"><li>• the shop floor</li><li>• in jigs</li><li>• on the aircraft itself.</li></ul> <p>Riveting and bucking may be performed on vertical, horizontal, overhead, or on a variety of different surface shapes.</p>
<b>Job Performance Measures Most Often Impacted by Riveting/Bucking:</b>	<ul style="list-style-type: none"><li>• The quality of the rivet</li><li>• The speed of task completion.</li></ul>
<b>Typical Employee Comments about Riveting/Bucking:</b>	<p>Employees commonly report of upper extremity, back, foot discomfort. Employees repeatedly identify stabilizing the bucking bar as a primary source for upper extremity discomfort.</p> <p>Primary: varies depending on the task</p> <p>Secondary: varies depending on the task</p>
<b>Suggested Level II Analysis:</b>	Grip Force Measurement, Elemental Task Analysis

## Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			Minor Modification	Major Change		Quality	Productivity
1. Reaching	<ul style="list-style-type: none"> <li>• Work location is too high</li> <li>• Gun must be manually supported, held or steadied</li> </ul>	<p>123. Raise the person</p> <ul style="list-style-type: none"> <li>• use a step stool, platform or ladder</li> <li>• provide an adjustable platform or scaffolding</li> </ul> <p>32. Lower the work piece/work surface</p> <p>117. Provide support for the upper body</p> <ul style="list-style-type: none"> <li>• rest arms on near-by surfaces</li> <li>• provide flexible armrests</li> </ul>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	low to med high	med med	med high

## Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change	Quality	Productivity	
	<ul style="list-style-type: none"> <li>• Work location is too far away from worker</li> <li>• Work location is blocked or is in an inappropriate orientation</li> </ul>	<p>41. Move work piece closer to body</p> <ul style="list-style-type: none"> <li>• provide adjustable height table or work surface</li> <li>• provide fixture or jig which can hold part, reorient part either horizontally or vertically, and eliminate reaches</li> </ul> <p>38. Move closer to the work location</p> <ul style="list-style-type: none"> <li>• move person closer to the work</li> <li>• provide sit-stand capability</li> </ul> <p>112. Provide support for the arms</p> <ul style="list-style-type: none"> <li>• rest arms on nearby surfaces</li> <li>• provide flexible arm rests</li> </ul> <p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> <li>• perform activity as bench work rather than on the aircraft/structure</li> </ul> <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> <li>• add access panels to increase access</li> <li>• increase the size of access ports to increase access</li> </ul> <p>103. Provide extensions for tools</p>	<span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span>	<span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span> <span style="font-size: 2em;">✓</span>	high med low med low med med med high high med	med med med med med med med med high med med	high med med med med med med med high med med

## Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change	Quality Productivity		
2. Arm forces: Repeated contraction of the muscles of the arm or holding/carrying materials	<ul style="list-style-type: none"> <li>Force required to perform operation is high (see Figure 1.1)</li> </ul> 	<p>76. Provide a tool which requires minimal force to use</p> <ul style="list-style-type: none"> <li>provide alternative riveter</li> </ul> <p>116. Provide support for the tool</p> <ul style="list-style-type: none"> <li>provide a jig such that the riveter and buck are not held simultaneously</li> </ul>		✓ ✓	high med	med med	high med
3. High speed, sudden shoulder movements	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>					

## Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change	Quality Productivity		
4. Head/neck bent or twisted	<ul style="list-style-type: none"> <li>• Work location is too low</li> <li>• Work location is too high</li> <li>• Work location is blocked or is in an inappropriate orientation</li> </ul>	<p>124. Raise the work piece/work surface</p> <ul style="list-style-type: none"> <li>• provide a fixed table to raise the work piece</li> <li>• provide an adjustable table</li> </ul> <p>31. Lower the person</p> <ul style="list-style-type: none"> <li>• provide a chair/stool to sit on for all or parts of the task</li> </ul> <p>123. Raise the person</p> <ul style="list-style-type: none"> <li>• use a step stool or ladder</li> <li>• provide an adjustable platform or scaffolding</li> </ul> <p>32. Lower the work piece/work surface</p> <p>136. Rotate the work piece (bench work)</p> <ul style="list-style-type: none"> <li>• turn the work piece manually</li> <li>• provide a fixture to allow the work piece to be rotated</li> </ul> <p>114. Provide support for the head</p> <ul style="list-style-type: none"> <li>• Provide a cushion to support the head</li> </ul>	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	low to med high med med to high high low low med low	med med med med med med med med med	med med med med med med med med med

## Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Light levels are too low</li> </ul>	<p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> <li>• perform some activities as bench work rather than on the aircraft/structure</li> </ul> <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> <li>• add access panels to increase access</li> <li>• increase the size of access ports to increase access</li> </ul> <p>22. Increase light levels</p> <ul style="list-style-type: none"> <li>• provide light levels at the task of 50-100 foot-candles (500 - 1000 lux)</li> <li>• provide a task light which is easy to adjust</li> <li>• increase room lighting</li> </ul>		✓ ✓ ✓ ✓ ✓ ✓	med high high high med high	med med med high med high	

## Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Bent wrists/repeated wrist movements or repeated forearm rotation	<ul style="list-style-type: none"> <li>Using riveter or buck on surface which requires poor orientation of riveter (see Figure 1.2)</li> </ul>  <p><b>Figure 1.2</b></p> <ul style="list-style-type: none"> <li>Difficult to reach riveting or bucking operation</li> </ul>	<p>136. Rotate the work piece (bench work)</p> <ul style="list-style-type: none"> <li>provide a fixture to orient the work piece to allow straight wrist postures</li> </ul> <p>77. Provide a tool with an appropriate handle angle</p> <ul style="list-style-type: none"> <li>the handle angle should allow the wrists to remain straight while working</li> </ul> <p>79. Provide a work surface which is adjustable in height</p> <p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> <li>perform some activities as bench work rather than on the aircraft/structure</li> </ul> <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> <li>add access panels to increase access</li> <li>increase the size of access ports to increase access</li> </ul>		✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	high	med	high
				✓	high	med	med

## Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
6. Repeated manipulations with fingers	<ul style="list-style-type: none"> <li>Setup and cleaning require many finger movements</li> <li>Handling and placing rivets requires many manipulations</li> </ul>	16. Improve cleat design 98. Provide automatic or semi-automatic feed for fasteners <ul style="list-style-type: none"> <li>riveter with automatic or semi-automatic feed</li> </ul>		<ul style="list-style-type: none"> <li>✓</li> <li>✓</li> </ul>	med  med	med  med	med  med
7. Hyper-extension of finger/thumb or repeated single finger activation	<ul style="list-style-type: none"> <li>Single-finger trigger</li> </ul>	62. Provide a multi-finger trigger <ul style="list-style-type: none"> <li>provide a tool with a multi-finger trigger</li> </ul>		✓	med	med	med
8. Hand/grip forces	<ul style="list-style-type: none"> <li>Work piece must be manually supported, held, or steadied</li> <li>Tool is too heavy</li> <li>Handle diameter is too large</li> </ul>	118. Provide support for the work piece <ul style="list-style-type: none"> <li>jig or fixture that supports the work piece such that the orientation and position allow easier access to part</li> <li>develop support for the tool for riveter</li> <li>develop a clampable buck for some tasks</li> </ul> 59. Provide a lighter weight tool <ul style="list-style-type: none"> <li>reduce the weight of the riveter</li> </ul> 88. Provide an appropriate handle diameter		<ul style="list-style-type: none"> <li>✓</li> <li>✓</li> <li>✓</li> <li>✓</li> </ul>	med  med  med  med	med  med  med  med	med  med  med  med

## Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Air hose must be manually supported, held, or steadied</li> <li>• Work piece must be manually repositioned</li> </ul>	<p>112. Provide support for the arms</p> <ul style="list-style-type: none"> <li>• rest arms on nearby surfaces</li> <li>• provide flexible armrests</li> </ul> <p>113. Provide support for the cable or hose</p> <ul style="list-style-type: none"> <li>• use hook to hang hose on nearby structure</li> </ul> <p>116. Provide support for the tool</p> <p>118. Provide support for the work piece</p> <ul style="list-style-type: none"> <li>• use jig or fixture to reduce/eliminate the need for gripping</li> </ul>	✓  ✓  ✓	✓  ✓  ✓	low med  low  med	low med  med  med	low med  med  med

## Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
9. High speed hand/wrist/arm movements (impact)	<ul style="list-style-type: none"> <li>Excessive vibration (see Figure 1.3)</li> </ul> 	<p>74. Provide a tool that minimizes exposure to vibration/impact/torque</p> <ul style="list-style-type: none"> <li>• riveter with better vibration characteristics</li> <li>• improved maintenance scheduling</li> <li>• provide vibration dampening material on handle</li> </ul>		✓ ✓ ✓	med med med	med med med
10. Exposure to hard edges	<ul style="list-style-type: none"> <li>Hard/sharp edges present in worksite</li> <li>Work piece has hard or sharp edges</li> <li>Tool handle has sharp edges</li> </ul>	<p>9. Eliminate exposure to hard edges</p> <ul style="list-style-type: none"> <li>• use gloves that are: <ul style="list-style-type: none"> <li>- cut resistant</li> <li>- high friction</li> <li>- padded palms</li> </ul> </li> <li>• modify or purchase a new handle for tools with: <ul style="list-style-type: none"> <li>- padding to reduce/eliminate contact</li> <li>- handle with increased surface area</li> </ul> </li> </ul>	✓	✓	low to med med	med med

## Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
		9. Eliminate exposure to hard edges <ul style="list-style-type: none"> <li>• by covering sharp edges or exposed corners:<ul style="list-style-type: none"> <li>- with padding</li> <li>- by rounding off</li> </ul></li> </ul>	✓	✓	low to med	med
11. Hands and fingers exposed to cold temperatures	• Rarely occurs	N/A				

## Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On
			✓ Minor Modification	✓ Major Change	Quality Productivity
12. Repeated forward or sideways bending movements	<ul style="list-style-type: none"> <li>• Work surface too low (see Figure 1.4)</li> </ul>  <p><b>Figure 1.4</b></p>	<p>124. Raise the work piece/work surface</p> <ul style="list-style-type: none"> <li>• provide an adjustable work surface</li> <li>• provide fixture or jig which can hold part, reorient part either horizontally or vertically, and eliminate reaches</li> </ul> <p>31. Lower the person</p> <ul style="list-style-type: none"> <li>• provide chair or stool</li> </ul> <p>136. Rotate the work piece</p> <ul style="list-style-type: none"> <li>• manually reorient the work piece</li> <li>• provide a jig or fixture to allow the work piece to be rotated</li> </ul> <p>77. Provide a tool with an appropriate handle angle</p> <ul style="list-style-type: none"> <li>• reorient riveter handle</li> <li>• reorient buck handle</li> </ul> <p>103. Provide extensions for tools</p> <ul style="list-style-type: none"> <li>• riveter with lengthened handle</li> </ul>	✓ ✓ ✓ ✓ ✓ ✓	high med med med low med med med low med	med med med med med med med med med

## Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Twisting of the lower back	<ul style="list-style-type: none"> <li>• Location of work</li> </ul>	41. Move work piece closer to body <ul style="list-style-type: none"> <li>• provide adjustable height table or work surface</li> <li>• provide fixture or jig which can hold part, reorient part either horizontally or vertically, and eliminate reaches</li> </ul> 38. Move closer to the work location	✓ ✓	✓ ✓ ✓	high med low	med med med	high med med
14. High speed, sudden movements	<ul style="list-style-type: none"> <li>• Rarely occurs</li> </ul>	N/A					
15. Static, awkward back postures	<ul style="list-style-type: none"> <li>• Work location is too low</li> <li>• Work location is too far away</li> </ul>	124. Raise the work piece/work surface <ul style="list-style-type: none"> <li>• provide a fixed table to support work piece</li> <li>• provide an adjustable table for work piece</li> </ul> 38. Move closer to the work location 32. Remove obstructions 41. Move work piece closer to body 136. Rotate the work piece <ul style="list-style-type: none"> <li>• rotate the work piece manually</li> <li>• provide a fixture to allow the work piece to be rotated</li> </ul>	✓ ✓ ✓	✓ ✓ ✓	med high low low low	med med low low low	med high low low low

## Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		<p>117. Provide support for the upper body</p> <ul style="list-style-type: none"> <li>• provide a padded surface to support upper body where work requires a bent or awkward posture</li> </ul> <p>103. Provide extensions for tools</p> <p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> <li>• perform activity as bench work rather than on the aircraft/structure</li> </ul> <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> <li>• add access panels to increase access</li> <li>• increase the size of access ports to increase access</li> </ul>		✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	high	med	high
				✓	high	med	med

## Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
	<ul style="list-style-type: none"> <li>Chair or stool provides inadequate back support</li> </ul>	115. Provide support for the lower back <ul style="list-style-type: none"> <li>pull chair forward and lean back while working</li> <li>adjust back rest to support lower back</li> <li>attach a small pillow to back rest to support lower back</li> <li>provide chair with lower back support</li> </ul>	✓ ✓ ✓	✓	low low low med	low low low low
16. Lifting forces	<ul style="list-style-type: none"> <li>if occurring, see Lifting Case Study</li> </ul>	N/A				
17. Pushing or pulling	<ul style="list-style-type: none"> <li>if occurring, see Lifting Case Study</li> </ul>	N/A				
18. Whole body vibration	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A				

## Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change	Quality	Productivity	
19. Fixed position, standing	<ul style="list-style-type: none"> <li>Standing surface is hard</li> </ul>	86. Provide an appropriate anti-fatigue mat  96. Provide appropriate shoe inserts  52. Provide a footrail or footrest	✓  ✓  ✓	✓  ✓  ✓	med  low  low to med	med  med  med	med  med  med
20. Exposure to hard edges on legs, knees, and feet	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
21. Awkward leg postures	<ul style="list-style-type: none"> <li>Work location is too low(see Figure 1.5)</li> </ul> 	124. Raise the work piece/work surface <ul style="list-style-type: none"> <li>provide an adjustable work surface</li> <li>provide fixture or jig which can hold part, reorient part either horizontally or vertically, and eliminate reaches</li> </ul> 31. Lower the person <ul style="list-style-type: none"> <li>provide chair</li> </ul>		✓  ✓  ✓	high  med  med	med  med  med	high  med  med

Figure 1.5

### Legs/Feet (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
22. Standing foot pedal	• Rarely occurs	N/A				

## Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity
23. Difficult to see/light levels too low/too high	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
24. Intensive visual tasks, staring at work objects for long periods	<ul style="list-style-type: none"> <li>Light levels are too low</li> <li>Task lacks variety</li> </ul>	<p>22. Increase light levels</p> <ul style="list-style-type: none"> <li>provide a task light which is easy to adjust</li> <li>increase room lighting</li> </ul> <p>20. Incorporate rest pauses</p> <p>25. Increase task variety</p>	✓    ✓    ✓    ✓    	✓    ✓    low    low	med    med    low    low	med    high    med    med	med    med    med    med